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10/524,546	11/01/2005	Kenichiro Nakajima	Q71952	1419

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EXAMINER	
GARDNER, SHANNON M	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/524,546	NAKAJIMA, KENICHIRO	
	Examiner	Art Unit	
	Shannon Gardner	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 April 2009 (Applicant's Arguments)*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-8 and 11* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-8 and 11* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

Applicant's amendment of 4/27/2009 does not render the application allowable.

Remarks

Applicant has amended claim 1 and added new claim 11. Currently claims 1, 3-8 and 11 are pending in the application and are considered on their merits below.

The Examiner notes that Applicant has indicated claim 11 as "previously presented". However, claim 11 is a new claim. Appropriate correction is required.

Status of Objections and Rejections

All rejections from the previous office action are withdrawn in view of Applicant's amendments. New grounds of rejection necessitated by the amendments are set forth below.

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

3. Claims 1, 4, 5-6 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa et al. (*Microstructures and Thermoelectric Properties of $(FeSb_3)_{1-x}La_x$ Ribbons*) in view of Lange (*Lange's Handbook of Chemistry, Table 3.2*) and Knosp et al. (US 20020037453).

As to claim 1, Kitagawa is directed to a method for producing a filled skutterudite-based alloy (pp 334; 1st column, **abstract**), comprising:

- melting alloy ray material of La, Fe and Sb to form a melt (pp 334; 1st column, **abstract** and 2nd column, 1st paragraph); and
- Rapidly quenching the melt to form a solidified product (pp 334; 1st column, 3rd paragraph and 2nd column, 1st paragraph).

Though Kitagawa teaches that the alloy raw material is melted in a high frequency induction furnace (pp 334; 2nd column, 1st paragraph) and rapidly solidified via strip casting on a copper roll (pp 334; 2nd column, 1st paragraph) but is silent as to melting the raw material at a temperature of 800 to 1,800 °C and as to quenching the melt at a cooling rate of $5x10^2$ to $3x10^3$ °C/second through spin casting.

However, Kitagawa teaches that pure Fe, Sb and La were weighed and melted together (pp 334; 2nd column, 1st paragraph). The melting points of Fe, Sb and La are 1535 °C, 630.7 °C, and 920 °C, respectively (see Lange's Handbook). A skilled artisan would appreciate that the three metals would be heated to a minimum temperature of 1535 °C to ensure complete melting of the metals.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to heat the metals of Kitagawa to at least 1535 ^{o}C, as this temperature allows for sufficient melting, and therefore mixing of the three metals present in the alloy and allow one skilled in the art to obtain the desired metal composition.

Further, Knosp teaches an alloy comprising a rare earth metal, a transition metal, and metallic antimony (paragraph [0009]) that is melted and rapidly cooled using either a melt spinning process *or* strip casting [emphasis added] at a cooling rate of 10 ^{o}C/second to 10^{6} ^{o}C/second (paragraphs [0034] and [0036]).

Therefore, a skilled artisan would recognize that the rapid quenching of the melt by a spin process or strip casting would be obvious to try over one another with a reasonable expectation of success (see MPEP § 2141(III)). The Examiner notes that in the case where claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists (*In re Wertheim* and MPEP § 2144.05(I)).

The Examiner notes that whatever vessel is used to collect the finished product of the modified references reads on the instant "receiving box".

Regarding claim 4, modified Kitagawa teaches the solidified product comprising alloy strips having a thickness of 0.1mm (Knosp; paragraph [0036]). The Examiner notes that in the case where claimed ranges "overlap or lie inside ranges disclosed by the prior art" a *prima facie* case of obviousness exists (*In re Wertheim* and MPEP § 2144.05(I)).

Regarding claim 5, modified Kitagawa teaches that the skutterudite-based alloy contains a filled skutterudite phase in an amount of 100 mass% (Kitagawa; pp 335, 2nd column, 1st paragraph and Figure 5). The Examiner notes that even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself (MPEP § 2113).

Regarding claim 6, modified Kitagawa teaches a filled skutterudite phase in an amount of at least 95 vol. % (Kitagawa; pp. 335, 2:9 and Fig. 5) and a phase, other than the filled skutterudite phase, having a maximum grain diameter of 10 um or less (Kitagawa; Fig. 2, Fig. 3 and p. 335, 2:16-20). The examiner notes that even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself (see MPEP § 2113).

Regarding claim 8, modified Kitagawa teaches a thermoelectric element fabricated using the filled skutterudite-based alloy (pp 335, 1st column, 1st paragraph).

4. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa et al. (*Microstructures and Thermoelectric Properties of* $(FeSb_3)_{1-x}La_x$ *Ribbons*) in view of Lange (*Lange's Handbook of Chemistry, Table 3.2*) and Knosp et al. (US 20020037453) as applied to claim 1 above, and further in view of Hehmann et al. (WO199604409).

Regarding claim 3, Applicant is directed above for a full discussion of Kitagawa in view of Lange and Knosp as applied to claim 1. Modified Kitagawa teaches that the alloy ray material is melting in an inert gas atmosphere (argon atmosphere) (Kitagawa; pp 334, 2nd column, 1st paragraph), but is silent as to the specific atmospheric pressure.

However, it is known in the rare earth metal alloy art that melting the alloy raw material in an inert atmosphere (Ar) at a highest possible atmospheric pressure minimizes losses of the melt due to evaporation, as taught by Hehmann (pp 31, section 1.1.2).

One reading the Kitagawa as a whole would understand that the reference is not concerned with a particular pressure of the argon atmosphere and therefore selection of a particular pressure would have been within purview of one of ordinary skill in the art. Further, it would have been obvious to one of ordinary skill in the art at the time of the invention to melt the alloy raw material at a pressure higher than 0.1MPa and not higher than 0.2MPa, to minimize losses of the melt due to evaporation, as taught by Hehmann (also see MPEP § 2141 (III)).

5. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa et al. (*Microstructures and Thermoelectric Properties of* $(FeSb_3)_{1-x}La_x$ *Ribbons*) in view of Lange (*Lange's Handbook of Chemistry, Table 3.2*) and Knosp et al. (US 20020037453) as applied to claim 5 above, and further in view of Hirota et al. (US 6322637).

Regarding claim 7, Applicant is directed above for a full discussion of Kitagawa in view of Lange and Knosp as applied to claim 5. Modified Kitagawa teaches the percentage of atoms in the metal alloy ribbons are 100% $LaFe_2Sb_{12}$ (Kitagawa; pp 335, 2nd column, 1st paragraph) and that the individual metals were melted in an inert atmosphere (Ar) (Kitagawa; pp 334, 2nd column, first paragraph), but is silent as to the

filled-skutterudite based alloy containing oxygen, nitrogen and carbon in a total amount of 0.2 mass% of less.

However, it is known in the rare earth metal alloy art to create such alloys with impurities in a total amount of 0.2 mass% or less, as taught by Hirota (column 2, line 6 to column 3, line 7) to achieve desired design characteristics.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to keep the oxygen, nitrogen and carbon content of modified Kitagawa's alloy 0.2 mass% or less, as taught by Hirota to achieve desired design characteristics.

6. Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kitagawa et al. (*Microstructures and Thermoelectric Properties of* $(FeSb_3)_{1-x}La_x$ *Ribbons*) in view of Lange (*Lange's Handbook of Chemistry, Table 3.2*) and Knosp et al. (US 20020037453) as applied to claim 1 above, and further in view of Masumoto et al. (US 4572750).

Regarding claim 11, Applicant is directed above for a full discussion of modified Kitagawa as applied to claim 1. The references are silent as to the receiving box being cooled at a rate of 2°C/sec at a temperature within in the range of 700°C to 500°C.

However, it is known in the alloy preparation art to utilize a twice cooling method wherein the alloy is first quickly cooled and then at an order-disorder transformation point the alloy is then cooled at a slower rate to achieve a preferred degree of order as taught by Masumoto (column 2, line 44 to column 3, line 12). **Note:** The alloy of

Masumoto is cooled to room temperature and therefore will also be cooled within the range of 700°C to 500°C.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to utilize a twice cooling method wherein the alloy is cooled at a slower rate (100°C/sec to 1°C/hour, which reads on the instant 2°C/sec) as taught by Masumoto in the preparation of the alloy as taught by modified Kitagawa to achieve a preferred degree of order in the alloy.

Further, the Examiner notes that the use of refrigeration as a cooling method is well known to one of ordinary skill in the art. Choosing a desired cooling method (such as refrigeration, or cooling a receiving box) would have been within purview of one of ordinary skill in the art.

Response to Arguments

7. Applicant's arguments filed 4/27/2009 have been fully considered but they are not persuasive:

Applicant argues that "The casting method which Kitagawa et al discloses...is a spin-cast method, not a strip-casting method" (pp 5 of Arguments).

The Examiner notes that in the Office Action dated 12/26/2008 on pp 3 it should be stated that "Kitagawa teaches that the alloy raw material is melted in a high frequency induction furnace (pp 334; 2nd column, 1st paragraph) and rapidly solidified via strip casting on a copper roll (pp 334; 2nd column, 1st paragraph) but is silent as to melting the raw material at a temperature of 800 to 1,800 °C and as to quenching the melt at a cooling rate of $5x10^2$ to $3x10^3$ °C/second through spin casting". The Examiner

apologizes for the typographical error. However, as is pointed out in the previous office action, Knosp teaches the interchangeable use of either spin casting OR strip casting as a method of quenching. One of ordinary skill in the art would have recognized that the methods are able to be used as equivalents with a reasonable expectation of success.

Applicant argues that "Since the crystal structure of the alloys of Kitagawa and Knosp are different, one of ordinary skill in the art would not have been led to combining the teachings of Kitagawa and Knosp" (pp 6 of Arguments).

The Examiner respectfully disagrees. Knosp teaches an alloy comprising a rare earth metal, transition metal and metallic antimony (paragraph [0009]) that is melted and cooled via melt spinning or strip casting. One reading either the Knosp and Kitagawa references as a whole would understand that both references are directed to solving the same problem – quickly and effectively quenching an alloy. Therefore, one of ordinary skill in the art at the time of the invention would have looked to the teaching of Knosp for methods of quenching an alloy.

Applicant argues that "the alloy claimed in Knosp differs from the alloy disclosed in paragraph [0009] of Knosp...the alloy disclosed in paragraph [0009] of Knosp...would not necessarily be manufactured even under the conditions of manufacture described..." (pp 7 of Arguments).

The Examiner notes that Knosp is relied upon a general teaching of methods of quenching an alloy. Knosp is *not* relied upon to teach the compositional elements/crystal structure of the claim. Kitagawa teaches the filled skutterudite composition needed for the instant claim. The rejection stands.

Applicant argues that "Knosp nowhere specifically discloses the range of $5x10^2$ °C/sec to $3x10^{30}$C/sec with any casting…" (pp 7 of Arguments).

The Examiner notes that the cooling rates taught by Knosp ($10\text{-}10^6$ °C/sec) overlaps with the instant range and discloses such a range in conjunction with strip casting (paragraphs [0034] and [0036]). The Examiner notes that in the case where the claimed ranges "overlap or lie inside ranges disclosed by the prior art a *prima facie* case of obviousness exists (MPEP 2144.05 and *In re Wertheim*).

Applicant argues that "The alloy disclosed in Hermann...differs [in composition] from that of the alloy disclosed in Knosp et al." (pp 10 of Arguments).

The Examiner notes that Hermann is relied upon as a general teaching of melting an alloy raw material in an inert atmosphere at a highest possible atmospheric pressure to minimize losses due to evaporation. Therefore, one of ordinary skill in the art would have looked to the teachings of Hermann to modify Knosp.

Applicant argues that "one of ordinary skill in the art would not have any reason to combine Hirota with Kitagawa" (pp 10 of Arguments).

The Examiner respectfully disagrees. Both Hirota and Kitagawa are directed to methods of alloy production. One of ordinary skill in the art would have looked to Hirota for teachings of maintaining low levels of oxygen, nitrogen, and carbon in the alloy of Kitagawa.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

§ 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Contact/Correspondence Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shannon Gardner whose telephone number is (571)270-5270. The examiner can normally be reached on Monday to Thursday, 8am-5pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alexa Neckel can be reached on 571.272.1446. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/S. G./
Examiner, Art Unit 1795

/Alexa D. Neckel/

Supervisory Patent Examiner, Art Unit 1795